

BAB VI

KESIMPULAN DAN SARAN

6.1 kesimpulan

Berdasarkan hasil yang telah diperoleh dalam penelitian maka dapat disimpulkan bahwa:

1. Identifikasi dan klasifikasi mangga madu matang, mangga madu mentah dan non mangga menggunakan *convolutional neural network (CNN)* telah berhasil dilakukan dengan hasil yang baik.
2. Pelatihan yang telah dilakukan untuk klasifikasi mangga matang, mangga mentah, dan non mangga cocok menggunakan arsitektur jaringan *convolutional neural network (CNN)*.
3. Menggunakan dropout regularization untuk meningkatkan jaringan pembelajaran telah memberikan hasil akurasi yang baik. Dengan adanya dropout regularization meningkatkan akurasi sebanyak 9.5%. Hasil akurasi yang diperoleh yaitu 81.64%.

6.2 Saran

Adapun saran untuk penelitian berikutnya adalah :

1. Menambahkan dataset yang lebih banyak akan menghasilkan akurasi yang lebih baik dan penambahan kelas lebih banyak akan membuat penelitian lebih variatif.
2. Penelitian yang telah berhasil dilakukan dapat diimplementasikan ke aplikasi mobile sehingga dapat dimanfaatkan oleh masyarakat luas dan diterapkan secara real time.

3. Modifikasi pada masing-masing arsitektur jaringan dapat menjadikan penemuan baru untuk hasil *inference* yang lebih baik.



DAFTAR PUSTAKA

- [1] R. Delima, H. B. Santoso, and J. Purwadi, "Architecture vision for Indonesian Integrated Agriculture Information Systems using TOGAF framework," *2016 Int. Conf. Informatics Comput. ICIC 2016*, no. Icic, pp. 66–71, 2017.
- [2] I. Lindu Mahargya, R. Eka Wahyuni, and G. Fajar Shidik, "Evaluation Forecasting Method of Farmers Terms of Trade Indonesian Agriculture," *Proc. - 2018 Int. Semin. Appl. Technol. Inf. Commun. Creat. Technol. Hum. Life, iSemantic 2018*, pp. 6–10, 2018.
- [3] F. N. Fajri, N. Hamid, and R. A. Premunendar, "The recognition of mango varieties based on the leaves shape and texture using back propagation neural network method," *Proc. - 2017 Int. Conf. Sustain. Inf. Eng. Technol. SIET 2017*, vol. 2018-Janua, pp. 14–20, 2018.
- [4] T. Devin and M. A. Agmalaro, "Mangifera indica real-time quality classifications using codebook segmentation and mass-size correlation equations," *ICACSYS 2015 - 2015 Int. Conf. Adv. Comput. Sci. Inf. Syst. Proc.*, pp. 207–213, 2016.
- [5] R. P. Salunkhe and A. A. Patil, "Image processing for mango ripening stage detection: RGB and HSV method," *Proc. 2015 3rd Int. Conf. Image Inf. Process. ICIIP 2015*, pp. 362–365, 2016.
- [6] S. B. Ullagaddi and S. V. Raju, "Disease recognition in Mango crop using modified rotational kernel transform features," *2017 4th Int. Conf. Adv. Comput. Commun. Syst. ICACCS 2017*, 2017.
- [7] T. W. Cenggoro, A. Budiarto, R. Rahutomo, and B. Pardamean, "Information System Design for Deep Learning Based Plant Counting Automation," *1st 2018 Indones. Assoc. Pattern Recognit. Int. Conf. Ina. 2018 - Proc.*, pp. 329–332, 2019.
- [8] A. S. M. F. Al Haque, M. R. Rahman, A. Al Marouf, and M. A. A. Khan, "A Computer Vision System for Bangladeshi Local Mango Breed Detection using Convolutional Neural Network (CNN) Models," *2019 4th*

- Int. Conf. Electr. Inf. Commun. Technol. EICT 2019*, no. December, pp. 1–6, 2019.
- [9] M. Rahnemoonfar and C. Sheppard, “Deep count: Fruit counting based on deep simulated learning,” *Sensors (Switzerland)*, vol. 17, no. 4, pp. 1–12, 2017.
- [10] G. Ciocca, P. Napoletano, and R. Schettini, “CNN-based features for retrieval and classification of food images,” *Comput. Vis. Image Underst.*, vol. 176–177, no. February, pp. 70–77, 2018.
- [11] T. Liu and T. Stathaki, “Faster R-CNN for robust pedestrian detection using semantic segmentation network,” *Front. Neurorobot.*, vol. 12, no. October, pp. 1–10, 2018.
- [12] S. W. Cho, N. R. Baek, M. C. Kim, J. H. Koo, J. H. Kim, and K. R. Park, “Face detection in nighttime images using visible-light camera sensors with two-step faster region-based convolutional neural network,” *Sensors (Switzerland)*, vol. 18, no. 9, 2018.
- [13] X. Cao *et al.*, “Region based CNN for foreign object debris detection on airfield pavement,” *Sensors (Switzerland)*, vol. 18, no. 3, pp. 1–14, 2018.
- [14] G. Liu, S. Mao, and J. H. Kim, “A mature-tomato detection algorithm using machine learning and color analysis,” *Sensors (Switzerland)*, vol. 19, no. 9, pp. 1–19, 2019.
- [15] R. I. H. Abushahma, M. A. M. Ali, O. I. Al-Sanjary, and N. M. Tahir, “Region-based convolutional neural network as object detection in images,” *Proceeding - 2019 IEEE 7th Conf. Syst. Process Control. ICSPC 2019*, no. December, pp. 264–268, 2019.
- [16] S. Dugad, V. Puliyadi, H. Palod, N. Johnson, S. Rajput, and S. Johnny, “Ship intrusion detection security system using image processing & SVM,” *2017 Int. Conf. Nascent Technol. Eng. ICNTE 2017 - Proc.*, 2017.
- [17] E. Medina, M. R. Petraglia, J. G. R. C. Gomes, and A. Petraglia, “Comparison of CNN and MLP classifiers for algae detection in underwater pipelines,” *Proc. 7th Int. Conf. Image Process. Theory, Tools Appl. IPTA 2017*, vol. 2018-Janua, pp. 1–6, 2018.

- [18] B. Hicham, A. Ahmed, and M. Mohammed, "Vehicle Type Classification Using Convolutional Neural Network," *Colloq. Inf. Sci. Technol. Cist*, vol. 2018-Octob, pp. 313–316, 2018.
- [19] M. A. Subhi and S. M. Ali, "A deep convolutional neural network for food detection and recognition," *2018 IEEE EMBS Conf. Biomed. Eng. Sci. IECBES 2018 - Proc.*, pp. 284–287, 2019.
- [20] M. Li, L. Kuang, S. Xu, and Z. Sha, "Brain Tumor Detection Based on Multimodal Information Fusion and Convolutional Neural Network," *IEEE Access*, vol. 7, pp. 180134–180146, 2019.
- [21] R. Yamparala, R. Challa, V. Kantharao, and P. S. R. Krishna, "Computerized classification of fruits using convolution neural network," *2020 7th Int. Conf. Smart Struct. Syst. ICSSS 2020*, pp. 10–13, 2020.
- [22] S. Bargoti and J. Underwood, "Deep fruit detection in orchards," *Proc. - IEEE Int. Conf. Robot. Autom.*, pp. 3626–3633, 2017.
- [23] H. Habaragamuwa, Y. Ogawa, T. Suzuki, T. Shiigi, M. Ono, and N. Kondo, "Detecting greenhouse strawberries (mature and immature), using deep convolutional neural network," *Eng. Agric. Environ. Food*, vol. 11, no. 3, pp. 127–138, 2018.
- [24] R. Kestur, A. Meduri, and O. Narasipura, "MangoNet: A deep semantic segmentation architecture for a method to detect and count mangoes in an open orchard," *Eng. Appl. Artif. Intell.*, vol. 77, no. September 2018, pp. 59–69, 2019.
- [25] A. Hutagalung, H. Nugroho, A. Suheryadi, and P. E. Yunanto, "Detection and Counting of Mango Fruits in Occluded Condition Using Image Analysis," *Proc. 2017 5th Int. Conf. Instrumentation, Commun. Inf. Technol. Biomed. Eng. ICICI-BME 2017*, no. November, pp. 190–195, 2018.
- [26] S. Bargoti and J. P. Underwood, "Image Segmentation for Fruit Detection and Yield Estimation in Apple Orchards," *J. F. Robot.*, vol. 34, no. 6, pp. 1039–1060, 2017.
- [27] W. Maldonado and J. C. Barbosa, "Automatic green fruit counting in

- orange trees using digital images,” *Comput. Electron. Agric.*, vol. 127, pp. 572–581, 2016.
- [28] S. Kido, Y. Hirano, and N. Hashimoto, “Detection and classification of lung abnormalities by use of convolutional neural network (CNN) and regions with CNN features (R-CNN),” *2018 Int. Work. Adv. Image Technol. IWAIT 2018*, pp. 1–4, 2018.
- [29] T. N. Pham, L. Van Tran, and S. V. T. Dao, “Early Disease Classification of Mango Leaves Using Feed-Forward Neural Network and Hybrid Metaheuristic Feature Selection,” *IEEE Access*, vol. 8, pp. 189960–189973, 2020.
- [30] C. Zhang, P. Yue, L. Di, and Z. Wu, “Automatic identification of center pivot irrigation systems from landsat images using convolutional neural networks,” *Agric.*, vol. 8, no. 10, 2018.
- [31] Y. F. Chen, F. S. Yang, E. Su, and C. C. Ho, “Automatic Defect Detection System Based on Deep Convolutional Neural Networks,” *2019 Int. Conf. Eng. Sci. Ind. Appl. ICESI 2019*, pp. 1–4, 2019.
- [32] I. Zarrin and S. Islam, “Leaf Based Trees Identification Using Convolutional Neural Network,” *2019 IEEE 5th Int. Conf. Conver. Technol. I2CT 2019*, pp. 1–4, 2019.
- [33] U. Shruthi, V. Nagaveni, and B. K. Raghavendra, “A Review on Machine Learning Classification Techniques for Plant Disease Detection,” *2019 5th Int. Conf. Adv. Comput. Commun. Syst. ICACCS 2019*, pp. 281–284, 2019.
- [34] H. Jain, A. Vikram, Mohana, A. Kashyap, and A. Jain, “Weapon Detection using Artificial Intelligence and Deep Learning for Security Applications,” *Proc. Int. Conf. Electron. Sustain. Commun. Syst. ICESC 2020*, no. Icesc, pp. 193–198, 2020.
- [35] T. Jiang, J. L. Gradus, and A. J. Rosellini, “Supervised machine learning: A brief primer,” *Behav. Ther.*, 2020.
- [36] J. J. Beunza *et al.*, “Comparison of machine learning algorithms for clinical event prediction (risk of coronary heart disease),” *J. Biomed. Inform.*, vol. 97, no. July, p. 103257, 2019.

- [37] M. A. jabbar, B. L. Deekshatulu, and P. Chandra, "Classification of Heart Disease Using K- Nearest Neighbor and Genetic Algorithm," *Procedia Technol.*, vol. 10, pp. 85–94, 2013.
- [38] A. Dutta, T. Batabyal, M. Basu, and S. Acton, "An Efficient Convolutional Neural Network for Coronary Heart Disease Prediction," *SSRN Electron. J.*, p. 113408, 2020.
- [39] S. Kaniş and D. Goularas, "Evaluation of Deep Learning Techniques in Sentiment Analysis from Twitter Data," *Proc. - 2019 Int. Conf. Deep Learn. Mach. Learn. Emerg. Appl. Deep. 2019*, pp. 12–17, 2019.
- [40] A. Saini and M. Biswas, "Object detection in underwater image by detecting edges using adaptive thresholding," *Proc. Int. Conf. Trends Electron. Informatics, ICOEI 2019*, no. Icoei, pp. 628–632, 2019.
- [41] A. Almutairi and M. Almashan, "Instance segmentation of newspaper elements using mask R-CNN," *Proc. - 18th IEEE Int. Conf. Mach. Learn. Appl. ICMLA 2019*, pp. 1371–1375, 2019.
- [42] E. Dandil and K. K. Cevik, "Computer Vision Based Distance Measurement System using Stereo Camera View," *3rd Int. Symp. Multidiscip. Stud. Innov. Technol. ISMSIT 2019 - Proc.*, pp. 6–9, 2019.
- [43] M. A. Momin, M. T. Rahman, M. S. Sultana, C. Igathinathane, A. T. M. Ziauddin, and T. E. Grift, "Geometry-based mass grading of mango fruits using image processing," *Inf. Process. Agric.*, vol. 4, no. 2, pp. 150–160, 2017.
- [44] F. A. Phang, J. Pusppanathan, and R. A. Rahim, "Portable Electrical Capacitance Tomography Device for Teaching and Learning of Engineering Instrumentation in Electrical Engineering Laboratory," *Proc. - 2017 7th World Eng. Educ. Forum, WEEF 2017- Conjunction with 7th Reg. Conf. Eng. Educ. Res. High. Educ. 2017, RCEE RHed 2017, 1st Int. STEAM Educ. Conf. STEAMEC 201*, pp. 400–404, 2018.
- [45] R. S. Ricman, R. Szabo, and A. Gontean, "A Comparative Analysis of Implementation Performances for Image Processing Applications Used to Control Robotic Arms," *Proc. - 2018 IEEE Int. Conf. Environ. Electr. Eng.*

- 2018 *IEEE Ind. Commer. Power Syst. Eur. IEEEIC/I CPS Eur. 2018*, pp. 1–6, 2018.
- [46] Q. Zhao, “Virtual Keyboard : A human-computer interaction,” *5th Annu. IEEE Int. Conf. Cyber Technol. Autom. Control Intell. Syst. June*, no. 614711110, pp. 321–325, 2015.
- [47] J. Van Der Neut *et al.*, “Ultrasonic synthetic-aperture interface imaging,” *IEEE Trans. Ultrason. Ferroelectr. Freq. Control*, vol. 66, no. 5, pp. 888–897, 2019.
- [48] A. Tamir *et al.*, “Detection of anemia from image of the anterior conjunctiva of the eye by image processing and thresholding,” *5th IEEE Reg. 10 Humanit. Technol. Conf. 2017, R10-HTC 2017*, vol. 2018-Janua, pp. 697–701, 2018.
- [49] V. Kajla, A. Gupta, and A. Khatak, “Analysis of x-ray images with image processing techniques: A review,” *2018 4th Int. Conf. Comput. Commun. Autom. ICCCA 2018*, pp. 1–4, 2018.
- [50] M. Vashisht and M. Bhatia, “Role of Mathematics in Image Processing,” *Proc. Int. Conf. Mach. Learn. Big Data, Cloud Parallel Comput. Trends, Prespectives Prospect. Com. 2019*, pp. 538–543, 2019.
- [51] P. Tamilarasi and R. U. Rani, “Diagnosis of Crime Rate against Women using k-fold Cross Validation through Machine Learning,” *Proc. 4th Int. Conf. Comput. Methodol. Commun. ICCMC 2020*, no. Iccmc, pp. 1034–1038, 2020.
- [52] J. L. García-Balboa, M. V. Alba-Fernández, F. J. Ariza-López, and J. Rodríguez-Avi, “Homogeneity test for confusion matrices: A method and an example,” *Int. Geosci. Remote Sens. Symp.*, vol. 2018-July, pp. 1203–1205, 2018.
- [53] A. L. Michal Segal-Rozenhaimera and V. C. Kamalika Dasd, “Cloud detection algorithm for multi-modal satellite imagery using.pdf.”.
- [54] S. Sudha, K. B. Jayanthi, C. Rajasekaran, and T. Sunder, “Segmentation of RoI in Medical Images Using CNN- A Comparative Study,” *IEEE Reg. 10 Annu. Int. Conf. Proceedings/TENCON*, vol. 2019-Octob, pp. 767–771,

2019.

- [55] M. Mody, M. Mathew, S. Jagannathan, A. Redfern, J. Jones, and T. Lorenzen, "CNN inference: VLSI architecture for convolution layer for 1.2 TOPS," *Int. Syst. Chip Conf.*, vol. 2017-Sept, pp. 158–162, 2017.
- [56] P. Bohra, J. Campos, H. Gupta, S. Aziznejad, and M. Unser, "Learning Activation Functions in Deep (Spline) Neural Networks," *IEEE Open J. Signal Process.*, vol. 1, pp. 295–309, 2020.
- [57] J. J. and Y. S. F. Li, "CS231n: Convolutional Neural Networks for Visual Recognition," *Stanford Univ.*, pp. 1–9, 2020.
- [58] M. Z. Alom, P. Sidike, T. M. Taha, and V. K. Asari, "Handwritten Bangla Digit Recognition Using Deep Learning," 2017.

